(12) UK Patent Application (19) GB (11) 2 294 656 (13) A

(43) Date of A Publication 08.05.1996

(21) Application No 9422413.6

(22) Date of Filing 07.11.1994

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(51) INT CL[6]
B23K 26/08

(52) UK CL (Edition O)
B3V VLC V202 V221 V231 V236 V255
B4B B70D

(56) Documents Cited
GB 2229388 A US 5200592 A US 4945203 A
US 4629858 A

(58) Field of Search
UK CL (Edition N) B3V , B4B
INT CL[6] B23K

(54) **Method and apparatus for the manufacture of textiles**

(57) A method of imparting a desired design or random pattern to a finished fabric comprises moving the impact point of an energy beam. eg. a laser beam 14 with respect to the fabric 2 to either change the visual appearance of the surface of the fabric or to cut holes in it of a predetermined shape and at predetermined relative positions. The method operates under the control of a microprocessor which is included in the apparatus. The energy beam may alternatively be ultrasound.

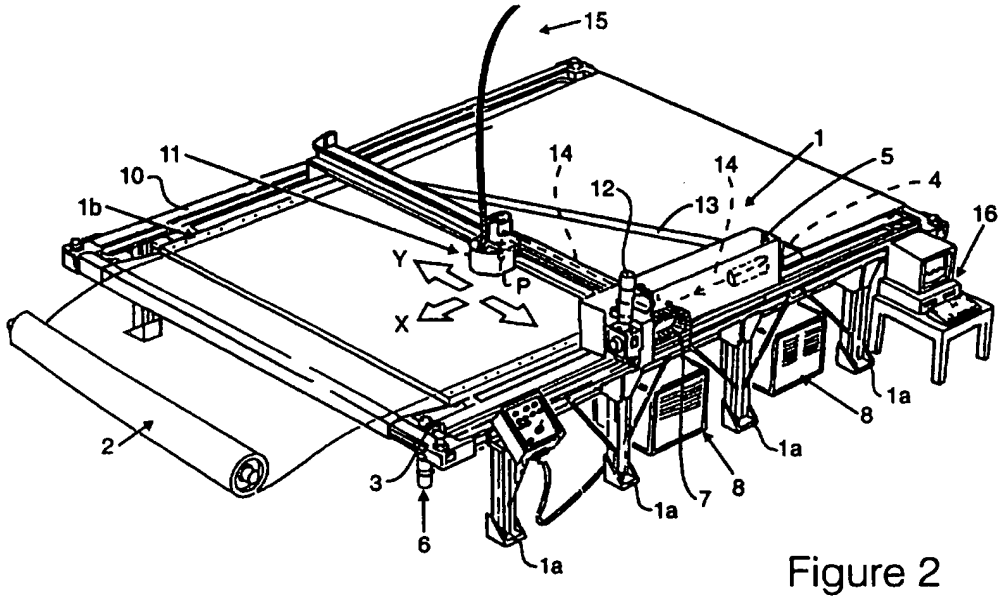

Figure 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

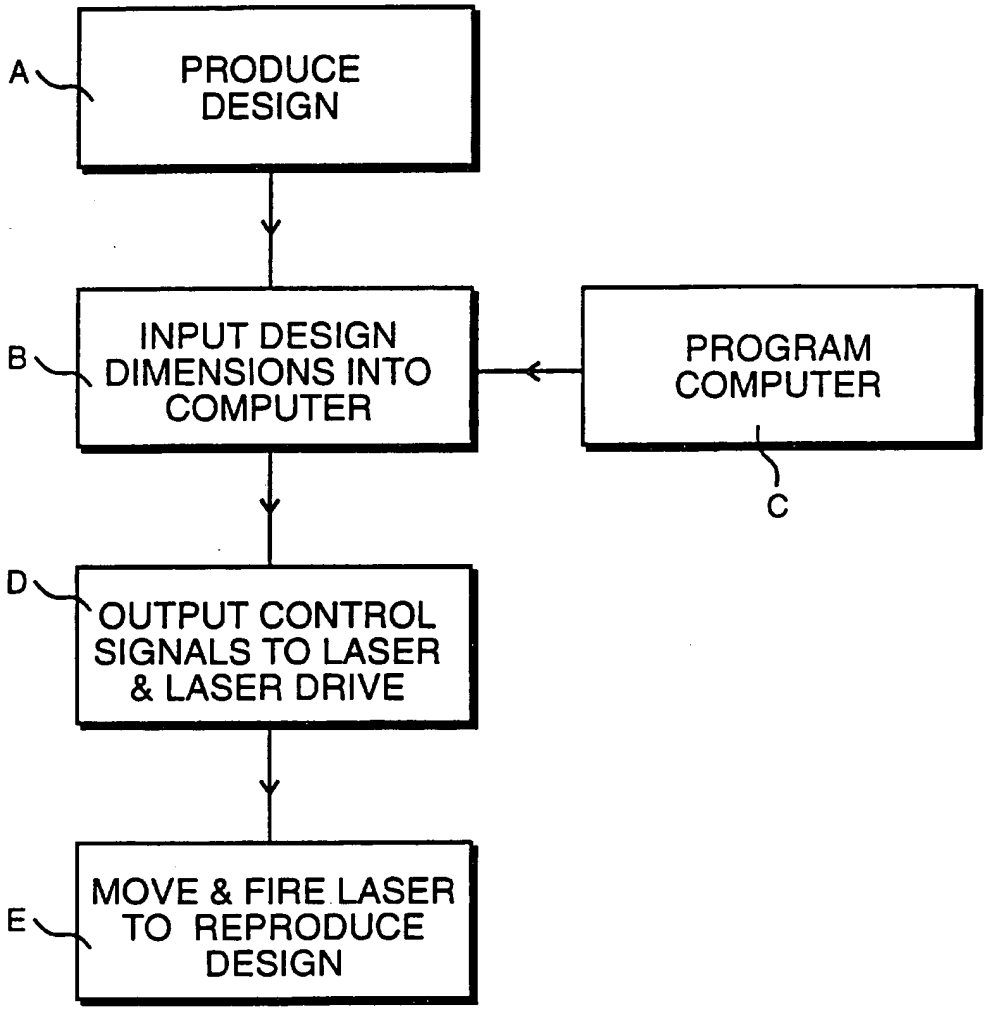
A
PRODUCE DESIGN
B
INPUT DESIGN DIMENSIONS INTO COMPUTER
PROGRAM COMPUTER
C
D
OUTPUT CONTROL SIGNALS TO LASER & LASER DRIVE
E
MOVE & FIRE LASER TO REPRODUCE DESIGN

Figure 1

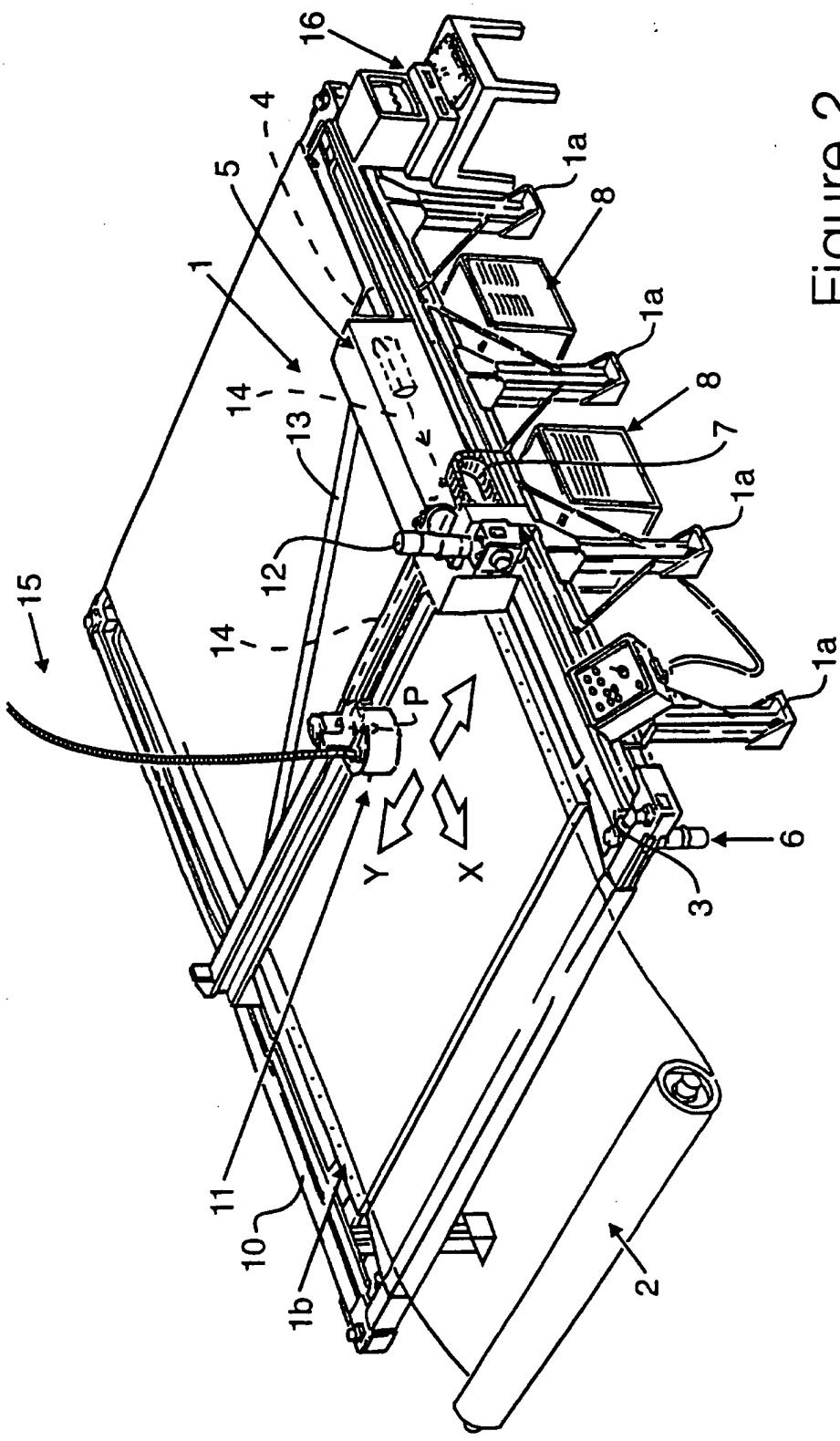

Figure 2

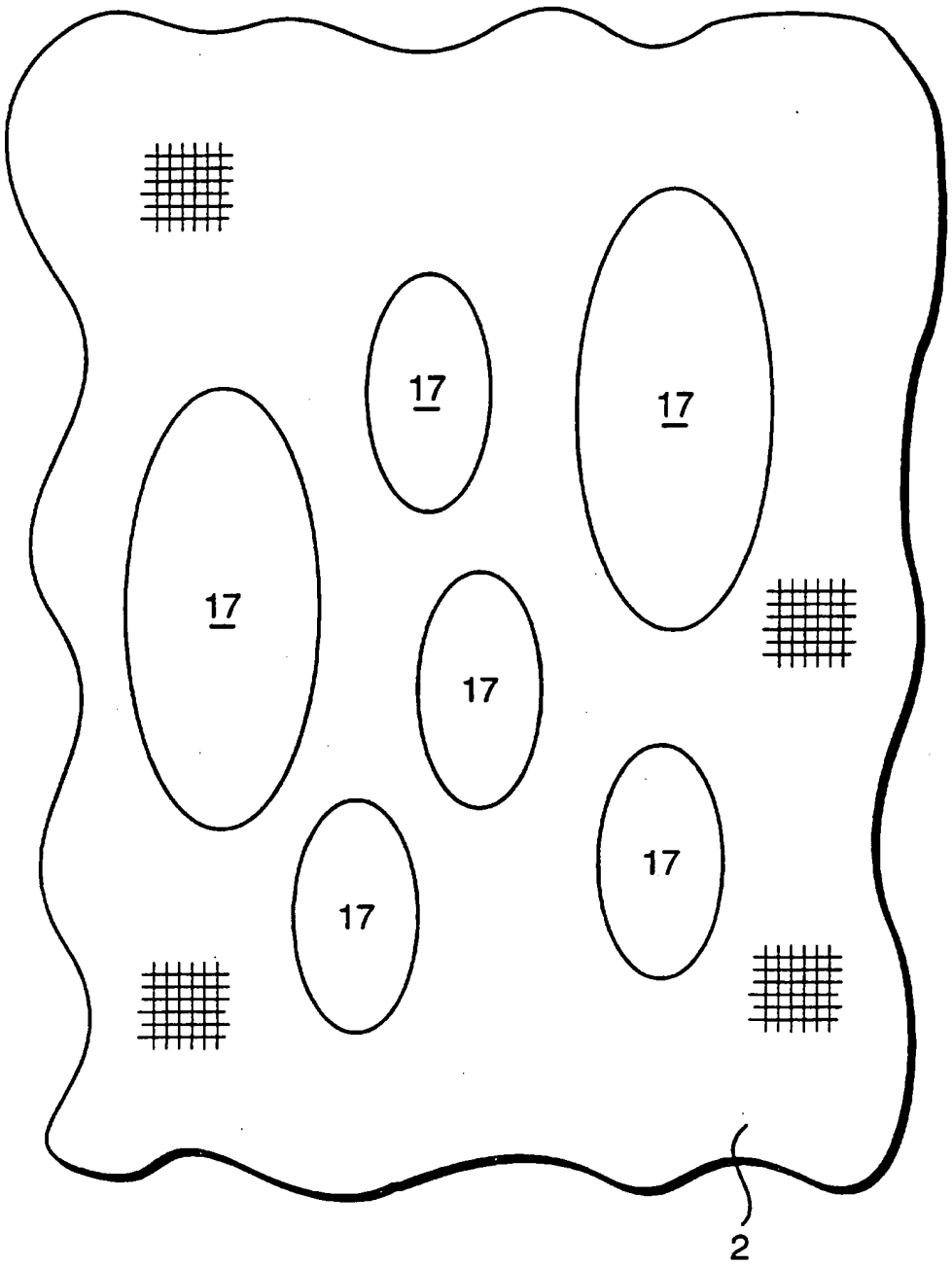

Figure 3

METHOD AND APPARATUS FOR THE MANUFACTURE OF TEXTILES

The present invention relates to methods and apparatus for the manufacture of textiles and more particularly to the formation of decorative patterns and/or textures on fabrics.

It is known to use ultrasonic energy to in effect weld certain fabric materials together, for example, at a seam as well as to cut fabrics. It is also known to cut materials, including fabrics, by means of a laser beam. There are also various known techniques for forming patterns on fabrics and to also manufacture lace or lace-like fabrics or materials. In connection with the latter there are various known methods of making lace material by means of a machine but this is complicated and expensive. There is also the so-called Devoré method of manufacturing lace-like fabrics or material.

In this latter method a material is woven from at least two different types of fibre, only one of which will dissolve when subjected to a selected chemical eg. an acid. In this method an acid resist is printed onto the material in order to define the desired pattern. The material is then treated with the acid which causes one of the two types of fibre to be dissolved in those areas not protected by the resist. The acid and resist are then washed away to leave the sheet of fabric or material with holes formed in it at desired locations in order to create a desired pattern.

This known process has a number of disadvantages. One of these disadvantages is ecological and associated with the problems involved in handling acids, disposing of any fumes generated by their use and finally disposing of the waste acid after it has been used. Another disadvantage is associated with the fact that where holes have been formed in the fabric or material the ends of fibres are exposed particularly in areas where the aperture or hole has a small radius of

curvature. Furthermore if apertures or holes are formed close together the material which defines the area between adjacent apertures or holes tends to be unstable.

The present invention is concerned with overcoming the above mentioned problems and with providing a method and apparatus for treating finished fabrics in order to provide them with an attractive, unusual and novel aesthetic and tactile finish.

According to the present invention a method of treating a finished or unfinished fabric comprises:

(a) producing a decorative design;

(b) incorporating that design into a computer program;

(c) providing a microprocessor unit;

(d) programming the microprocessor unit by means of the computer program;

(e) providing a computer controlled energy beam generator;

(f) connecting the energy beam generator to the said microprocessor unit;

(g) placing a fabric in a target zone of the said energy beam generator; and

(h) energising the said energy beam generator and moving it and said finished fabric relatively to one another to enable the impact point of the energy beam to trace a pattern on or in the fabric, said pattern being in accordance with said computer program.

According to the present invention apparatus for treating a finished fabric comprises:

(a) means for producing a decorative design;

(b) means for incorporating that design into a computer program;

(c) a microprocessor unit under stored program control;

(d) a computer controlled energy beam generator;

(e) a table upon which the said fabric can be placed; and

(f) means for energising the said energy beam generator and moving it and said finished fabric relatively to one another to enable the impact point of the energy beam to trace a pattern on or in the fabric, said pattern being in accordance with said computer program.

The term "energy beam generator" is intended to cover either an ultrasonic transmitter or a laser.

The phrase "trace a pattern on or in the fabric" is intended to cover either changing the surface finish of the fabric in order to in effect print or etch an already designed pattern on it or to cut holes in the fabric.

According to a further aspect of the present invention, instead of having a pre-designed pattern which is then translated into a computer program the microprocessor of the energy beam generator could be controlled by a program which is adapted to impart a random relative movement between the generator and the fabric together with random firing of the generator in order to provide a unique and to a significant extent random pattern on or in the fabric.

How the invention may be carried out will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a flowchart of a process or method according to the present invention;

Figure 2 is a perspective diagrammatic view of apparatus according to the present invention; and

Figure 3 illustrates an example of a pattern obtainable with the present invention.

Referring to Figure 1, a design or pattern to be reproduced on a finished fabric is first drawn either manually or by machine at A. The dimensions of that pattern are then input at B to a computer to be stored in its memory. These dimensions may either be input manually or the drawing of the pattern may be scanned by a scanning device such as a CCD. In a further alternative arrangement the designer of the pattern could produce that pattern on the screen of the computer and the dimensions of that pattern could then be input directly into the memory of the computer. In a further arrangement design information could be input into the computer from a remote location via eg. a telephone line and a facsimile machine.

The microprocessor unit of the computer operates on the basis of stored program control (as indicated at C) so that it can output signals at D which in turn control the movement and firing of a laser in relation to a sheet of fabric, as indicated at E.

Reference will now be made to Figure 2 which is a diagrammatic perspective view of one embodiment of apparatus for use in carrying out the present invention.

This apparatus consists of a table 1 of known construction, carried by supports 1a, the table having a large number of small holes 16 through which air can be drawn in order to in effect suck a sheet of fabric 2 onto the table and hold it there in a fixed position.

Down one side of the table 1 is a fixed longitudinally extending track 3 which track has mounted on it a carriage which in turn supports a casing 5 containing a laser 4.

The laser carriage and casing 5 together with the laser 4 are drivable along the track 3 by means of a motor 6 in the direction X.

The laser 4 is supplied with power through flexible cables 7 which are connected at one end to the laser 4 and at their other end to power supplies 8.

Also carried on the carriage is a transversely extending track 9 which is spaced above the upper surface of the table 1 and supported at its other end on a track 10 which is parallel to the track 3.

There is mounted on the track 9 a laser beam focusing head 11 which can be moved along the transverse track 9 by means of an electric motor 12 in the direction of the arrows Y.

A triangulation stabilising strut 13 interconnects the outer end of the track 9 with the carriage.

A laser beam 14 from the laser 4 is reflected within the casing 5 by a first 45 degree mirror (not shown) to exit the casing through an aperture in its side and then to be reflected downwardly by a second 45 degree mirror (not shown) carried by the laser beam focusing head 11.

By means of this apparatus it is possible to direct the laser beam 14 onto the fabric 2 held in position on the vacuum table 1 in order to either burn a pattern in the surface of the fabric or to cut the fabric.

A cooling fluid such as air or nitrogen is supplied to the focusing head 11 through a flexible pipe 15 which pipe is long enough to allow the head 11 to traverse substantially the full length of the transverse track 9. The laser beam between the two 45 degree mirrors would be enclosed in a casing (not shown) to protect users of the apparatus. Furthermore, such a casing, in the vicinity of the

focusing head 10 would be provided with a gas extraction duct (not shown) by which fumes generated by the laser acting on the fabric can be extracted from the working area to thus protect an operator of the machine. The volume and pressure of the gas can affect the quality of the cut as well as prevent combustion. It is therefore important to regulate these correctly in order to obtain the optimum cut.

With the arrangement shown in Figure 2 it is possible to move the point of impact P of the laser beam with the fabric 2 to any position on the fabric by a composite movement in the X and Y directions indicated. Having moved the focusing head 11 to the desired position the laser beam 14 would then be fired in order to either modify the surface of the fabric, and thus impart a pattern to it, or alternatively cut holes in the fabric.

The point of contact P of the laser beam 14 with the fabric would be controlled by a microprocessor unit 16 in accordance with a stored program which in turn is based on the originally designed pattern.

The laser used in the illustrated example of Figure 3 is a CO_2 laser having a 100 watt output. In fact an output of only 10 watts can be sufficient to impart the desired pattern to the fabric, depending upon the makeup of the fabric and its thickness.

An example of a suitable laser would be that produced by Avimo under the model designation PLT 100.

The process and apparatus of the present invention can be employed with fabrics which include materials which will melt when heated by the laser beam. Typically this means that the fabric will contain a proportion of synthetic fibres which proportion could be about 20 per cent. However, there is no limitation on the proportion of synthetic fibre as 2 per cent level will still allow a sealed cut to be obtained.

Furthermore, it is not necessary for the fabric itself to contain any synthetic fibre as the required sealing of the cut could be achieved by coating the fabric with a microfine coating of polymeric material. This would allow the invention to also be employed to treat natural fabrics.

The present invention enables a wide variety of fabrics, including woollen based fabrics to be converted into lace-like fabrics.

With the present invention the edges of any holes or apertures cut in the fabric will be sealed thus stabilising the woven material adjacent the aperture.

Figure 3 illustrates an example of a lace-like pattern which could be produced by means of the present invention. In this example ellipse like holes 17 are cut out of the fabric 2.

The present invention may also be employed to bond together a number of different fabrics. For example a linen may be cut simultaneously with a sheer polyester base fabric, these two fabrics being bonded together along the cut line(s).

The method and process of the present invention could be carried out using an ultrasonic beam generator instead of the laser previously described and shown in the drawings.

CLAIMS

1. A method of treating a fabric comprises:

(a) producing a decorative design;

(b) incorporating that design into a computer program;

(c) providing a microprocessor unit;

(d) programming the microprocessor unit by means of the computer program;

(e) providing a computer controlled energy beam generator;

(f) connecting the energy beam generator to the said microprocessor unit;

(g) placing a finished fabric in a target zone of the said energy beam generator; and

(h) energising the said energy beam generator and moving it and said finished fabric relatively to one another to enable the impact point of the energy beam to trace a pattern on or in the fabric, said pattern being in accordance with said computer program.

2. Apparatus for treating a fabric comprises:

(a) means for producing a decorative design;

(b) means for incorporating that design into a computer program;

(c) a microprocessor unit under stored program control;

(d) a computer controlled energy beam generator;

(e) a table upon which the said fabric can be placed; and

(f) means for energising the said energy beam generator and moving it and said finished fabric relatively to one another to enable the impact point of the energy beam to trace a pattern on or in the fabric, said pattern being in accordance with said computer program.

3. A method or apparatus as claimed in claim 1 or 2 respectively in which the energy beam generator comprises a laser.

4. A method or apparatus as claimed as claimed in claim 3 in which the laser is a CO_2 laser.

5. A method or apparatus as claimed in claims 1 or 2 respectively in which the energy beam generator comprises an ultrasonic transmitter.

6. A method or apparatus as claimed in any previous claim in which there are at least two layers of fabric which are bonded together along the lines of a cut or cuts produced by the energy beam.

7. A method substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

8. Apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9422413.6

Relevant Technical Fields

(i) UK Cl (Ed.N) B3V; B4B

(ii) Int Cl (Ed.6) B23K

Search Examiner
D N P BUTTERS

Date of completion of Search
8 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1-8

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X,Y	GB 2229389	(SUKHMAN)	X:2, 3, 4, 5 Y:6
X,Y	US 5200592	(JUKI)	X:1, 2, 3, 4 5 Y:6
Y	US 4945203	(SOODAK)	6
X,Y	US 4629858	(KYLE)	X:1, 2, 3, 4 5 Y:6

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